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Malted Sorghum on the Growth Performances, Carcass Characterisics and Meat Qaulity of Broilers

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Abstract: Local feed formulation is on the rise as the poultry sector is fast expanding. While most formulations are made with little or no scientific research, most poultry farmers go for local feeds than the commercial feed because of financial reasons. This study seeks to study the effect of using malted sorghum on the growth performance, carcass characteristics and meat quality of birds (Broilers). For this study twenty-five one-day old chicks were used and were divided into five groups (Group 1-5) of five chicks each. Group1 chicks were fed with 100%formulated feed, Group 2 chicks were fed with 25% commercial feed and 75% formulated feed, Group 3 were fed with 50% commercial feed and 50% formulate feed, group 4 were fed with 755% commercial and 25% formulated feed and Group 5 were fed with 100% commercial feed. The study period lasted for 8 weeks and the mean weight of the experimental chicks and control were taken and analysed. The results showed thatthe chicken that were fed 100% commercial feed had the highest growth rate and highest body weight followed by the one that was fed with 75% commercial feed while the one that was fed with 100% formulated feed has the least growth, while the least growth was observed in those fed 100% formulated feed. It was also observed that those fed higher percentages of commercial feed had better values in meat characteristic. There is therefore need for better fortification of such formulated feeds with more growth enhancing ingredients to boost their performance.

Key words: Malted Sorghum · Broilers · Carcass Characteristics · Meat Quality · Growth Performance

INTRODUCTION

Poultry farming is the raising of domesticated birds such as chickens, turkeys, ducks and geese, for the purpose of farming meat or eggs for food. Poultry are farmed in great numbers with chickens being the most numerous. More than 50 billion chickens are raised annually as a source of food, for both their meat and their eggs [1]. Chickens raised for eggs are usually called layers while chickens raised for meat are often called broilers. Poultry is the second widely eaten meat in the world, accounting for about 30% of meat [2].

Poultry feed has been produces from a variety of crops and food sources. Alternative crops in Nigeria especially those that can be used for industrial purposes have gained prominence in recent times. Sorghum is a genus of numerous species of grasses, one of which is raised for grain and many of which are used as fodder plants, either cultivated or as part of pasture. The plants are cultivated in warmer climates worldwide.

Sorghum grows in harsh environments where other crops do not grow well, just like other staple foods, such as cassava, that are common in impoverished regions of the world. It is usually grown without application of any fertilizers or other inputs by a multitude of small-holder farmers in many countries [3]. Grain sorghum is the third most important cereal crop grown in the United States and the fifth most important cereal crop grown in the world.

Other names include durra, Egyptian millet, feterita, Guinea corn, jwari (Marathi), Jowar, Juwar, Milo, Maize, Shallu, Sudan grass, cholam, jola (Kannada), jonnalu (Telugu), great millet, kafir corn, dura, dari, mtama and solam. Sorghum has been, for centuries, one of the most

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important staple foodsfor millions of poor rural people in the semiarid tropics of Asia and Africa. For some impoverished regions of the world, sorghum remains a principal source of energy, protein, vitamins and minerals [4].

In 2010, Nigeria was the world's largest producer of grain sorghum, followed by the United States and India. In developed countries and increasingly in developing countries such as India, the predominant use of sorghum is as fodder for poultry and cattle. Sorghum is used for food, fodder and the production of alcoholic beverages. It is drought tolerant and heat tolerantand is especially important in arid regions. It is an important food crop in Africa, Central America and South Asiaand is the "Fifth most important cereal crop grown in the world [5].

Malting of sorghum, like barley, involves steeping or soaking, germination and drying. The resultant product is a useful input in food and feed processing companies that is utilized for the manufacture of syrups, beverages, poultry feed, microbiological media and other useful products. Malted sorghum sprout (MSP) is a by-product of sorghum malting. The separated roots and shoots which are left after malt extraction from the young germinating sorghum seedlings are collectively called sorghum sprout.

MSP has a lot of prospect in the livestock industry as it is rich in organic nitrogen [6]. MSP contains (g/kg); 226 crude proteins, 48 crude fibre, 33 ether extract, 16 ash, 522 nitrogen free extract and 16.26 MJ/kg DM gross energy [7]. [8] reported that magnesium was the most abundant mineral while potassium was the least in MSP. Among the trace minerals, Zinc was reported to be the most abundant while copper is the least. Sorghum sprout is reported to also contain a considerable number of amino acids with low level of methionine, lysine and threonine [9] which are essential in improving both the rate of growth and the quality of meat in birds.

The anti-nutritional that have been reportedly found in MSP are tannin and hydrogen cyanide. [10] reported that tannins affect the growth of animals in three main ways: they have an astringent taste, which affects palatability and decreases feed consumption; they form complexes with proteins and reduce its digestibility and they act as enzyme inactivators. All these factors result from interaction of tannins and proteins to form soluble and insoluble complexes, an interaction that depends primarily on relative proportions of phenol and protein. Cyanide caused poisoning of the animal [11]. As a result, detoxification by means of processing might be a good means of reducing the level of these anti- nutritional factors and increase the use of MSP in animal feeding. The natural fermentation of meals of sorghum has an ion contents [12].

Micronutrients (Vitamins and minerals) are required for the integrity and optimal function of living animal systems. There are 13 accepted vitamins, 4 of which are lipid-soluble and 9 are water soluble. Absolute single vitamin deficiencies are rare, as they are most likely coupled with protein-energy malnutrition [13]. Nevertheless, some cases of specific nutrient deficiencies can be directly related to neurological diseases, as is the case for thiamin, whose discovery came as a result of relating peripheral neuropathies with rice polishing in Javanese birds [14].

Additionally, it is well known that niacin deficiency leads to reduced cognition and dementia; while a number of other B vitamins, especially B1, B2, B6, B12 and folic acid needed for synthesis of various neurotransmitters [15]. Here we examine which vitamin deficiencies induce neurological diseases in birds by congenital malformations, brain underdevelopment, inborn errors of metabolism, reduced catalytic capacity or inhibited product synthesis.

Basically, poultry feed comprises of both animal and plant source which could be gotten from: sorghum, barely, oat, cotton, seed, sunflower, peanut, wheat, rice, fish meal, bone meal [16]. The source to be used depends on the cost, availability and the nutritive constituent of poultry feeds and their sources.This study therefore, seeks to evaluate the effect of using malted sorghum on the growth performance, carcass characteristics and meat quality of birds (Broilers) as to recommend for poultry farmers

MATERIALS AND METHODS

Twenty-five (25) one-day-old broiler chicks of mixed sex were purchased from local hatchery while the sorghum was bought from the Abakaliki main market and were brought to the Department of Biotechnology, Ebonyi State University, Abakaliki where the experiment was carried out.

Formulation of Malted Sorghum: Two buckets of sorghum were steeped in water for four days, sundry and was milled. Both plant (Palm cannel cake and Soybeans) and animal (Blood agar, Fish meal and Bone meal) ingredients were used for the feed formulation.

The formulated feeds were given to birds in different percentages(100%, 75%, 50% 25% and 0% respectively).

Weight Determination: The weight of eachof the broilers was taken using a weighing balance every three-day interval.

Carcass Characteristics and Meet Quality: The carcass characteristics were determined by obtaining the weights of the breast, thigh, necks and back cut after slaughtering.The birds were made to fast overnight and were weighed before slaughtering. They were bled by section of the jugular veins, scalded in warm water of about 60°C and the feathers were manually plucked. The heads and legs were cut albinometarsus and the joints respectively. The weights of carcass, head, legs, hearts, gizzard and livers were obtained. The carcass were persevered in the refrigerator at 4°C for 24hours and reweighed, carcass was then caved out and the weights of the breast, thigh-drumstick, wings, neck and also the back were determined.

The meat samples were then placed in polythenebags and freely hanged up to a hook at 4°C during 48hours. Samples were mopped up and weighed for drip loss determination, replaced in polythene bags. The samples were then placed in hot water of about 75°C for 30 minutes, cooled for 40 minutes and mopped up. The difference in weight before and after cooking gave the cooking loss, expressed as a percentage of initial weight.

Statistical Analysis: All data obtained were analyzed by the Analysis of Variance (ANOVA) procedure using SAS software (SAS Institute, 1999). Differences were declared statistically significant at $P \leq 0.05$. Where significant differences were detected, the means were separated by least significant difference (LSD) at 5% probability.

RESULTS

The weekly mean body weight of the birds during eight weeks of treatment and the standard deviation are as shown in Table 2, there were not much differences in the growth of the birds during the first three weeks of acclimatization.

Week 1 had weight ranges from 800g - 890g, week 2 had weights from 900g - 945g, week 3 ranged from 985g - 1230g, week 4 ranges from 1400g - 520g, week 5 ranged from 1600g - 1770g, week 6 ranged from 1595g - 1700g, week 7 ranged from 1810g - 1895g and week 8 ranged from 1675g - 1860g. From the results obtained it showed that at different percentages, of the formulated feeds the growth rate was affected with increase in formulated feed, leading to a decrease in growth rate.

Group 5 which was fed with 100% commercial feed had the highest growth rate, followed by group 4 that was fed with 75% commercial feed and 25% formulated feed, followed by Group 3 that was fed with 50% commercial feed and 50% formulated feed, followed by Group 2 that was fed with 25% commercial and 75% formulated feed while Group 1 that was fed with 100% formulated feed had the least growth.

The Table (1) shows that there was no significant difference on the weights of the chicken when they were fed with commercial feed only, from week 1 to week 3. There was a significant difference when formulated feed was administered to the birds, from week 4 to week 8.

Table 1: Change in Weight of Broilers

	Group 1	Group 2	Group 3	Group 4	Group 5
Week 1	890±30.59^{a}	840±34^{b}	800±34.40^{b}	870±31.73^{a}	890±43.19^{a}
Week 2	9050±30.41^{b}	935±36.73^{a}	945±28^{a}	905±22.3^{b}	900±43.64^{b}
Week 3	1230±46.12^{a}	1135±21.43^{b}	1000±42.42^{c}	985±20.43^{c}	990±44.3^{c}
Week 4	1480±34.16^{b}	1480±58.62^{b}	1400±40.70^{c}	1480±44.02^{b}	1520±45.60^{a}
Week 5	1660±63.47^{c}	1600±82.70^{c}	1680±52.47^{b}	1770±61.47^{a}	1770±74.33^{a}
Week 6	1595±36.41^{c}	1665±67.43^{c}	1671±67.43^{c}	1740±43.04^{b}	1700±52.06^{a}
Week 7	1675±59.42^{d}	1690±98.48^{d}	1795±65.42^{c}	1830±41.42^{b}	1860±62.42^{a}
Week 8	1840±72.04^{c}	1840±42.84^{b}	1870±67.84^{b}	1920±54.08^{a}	1995±58.84^{a}

*Means followed with the same letter in each column are not significantly different ($p < 0.05$).

Table 2: Body Weight of BroilersBefore and After Death

Changesin weight	Group 1	Group 2	Group 3	Group 4	Group 5
Beforedeath	2517.66 ± 63.22^{a}	2508.77 ± 57.55^{a}	2480.66 ± 46.4^{b}	2133.34 ±73.99^{c}	1780.68 ± 65.99^{d}
after death	2367.66 ± 63.58^{a}	2335.33 ± 38.48^{b}	2334.437±43.42^{b}	2011.01 ± 34.30^{c}	1711.00 ± 48.44^{d}

*Means followed with the same letter in each column are not significantly different ($p<0.05$).

Table 3: Mean Weight of Different Parts of the Five Groups of Carcass before and after Preservation in Fridge at 4°C for 48hours

		Group 1	Group 2	Group 3	Group 4	Group 5
Head	Before	100±6.5^{b}	100±15.54^{b}	112.5±15.5^{a}	112.5±15.5^{a}	125±25.05^{a}
	After	75±9.50^{c}	75±9.50^{c}	87.5±1.5^{b}	87.5±4.5^{b}	100±15.54^{a}
Back cut	Before	250±20.05^{c}	250±12.25^{c}	287.5±25.75^{b}	325±21.5^{a}	325.5±16.55^{a}
	After	350±25.50^{a}	300±17.5^{b}	300±20.65^{b}	275±28.56^{c}	250±14.5^{b}
Breast	Before	337.5±38.50^{d}	362.5±32.54^{c}	400±20.5^{b}	400±21.05^{b}	462.5±26.75^{c}
	After	312.5±42.03^{d}	362.5±43.65^{c}	387.5±24.5^{b}	387.5±20.04^{b}	437.5±28.65^{a}
Drumstick	Before	387.5±32.54^{c}	425±18.05^{b}	425±20.65^{b}	412.5±36.54^{b}	500±30.5^{a}
	After	362.5±36.5^{c}	400±30.45^{b}	450±15.55^{a}	450±18.55^{a}	475±25.65^{a}
Liver	Before	50±3.45^{b}	62.5±4.35^{b}	75±3.45^{a}	75±2.54^{a}	87.5±4.05^{a}
	After	50±2.5^{c}	50±4.50^{b}	75±2.55^{a}	75±3.25^{a}	75±3.45^{a}
Legs	Before	112.5±15.5^{b}	112.5±12.75^{b}	125±15.32^{a}	125±15.65^{a}	137.5±14.05^{a}
	After	87.5±4.55^{c}	87.5±6.75^{c}	100±10^{b}	100±16.45^{b}	125±14.55^{a}
Neck	Before	100±5.66^{b}	100±10.2^{b}	125±9.55^{a}	125±15.56^{a}	137.5±18.55^{a}
	After	87.7±7.5^{b}	87.5±4.65^{b}	100±12.05^{a}	100±10.5^{a}	112.5±15.55^{a}
Gizzard	Before	62.5±5.45^{a}	62.5±3.4^{a}	62.5±2.65^{a}	62.5±5.75^{a}	75±2.5^{a}
	After	50±5.2^{b}	50±2.5^{b}	62.5±2.75^{a}	62.5±3.54^{a}	72±5.45^{a}
Heart	Before	25±1.5^{a}	25±2.5^{a}	25±1.5^{a}	25±2.0^{a}	25±2.0^{a}
	After	25±1.5^{a}	25±2.15^{a}	25±1.2^{a}	25±1.5^{a}	25±1.5^{a}
Wings	Before	212.5±21.5^{d}	237.5±23.5^{c}	262.5±22.05^{b}	262.5±25.25^{b}	300±20.5a
	After	237.5±24.5b^{d}	187.5±20.3^{c}	220±30.5^{b}	225±20.05^{b}	250±15.55^{a}

*Means followed with the same letter in each column are not significantly different ($p < 0.05$).

Table 4: The Cooking and Drip Loss

	Group 1	Group 2	Group 3	Group 4	Group 5
Drip loss	516.66 ± 22.58^{a}	502.01±25.29^{a}	511± 29.48^{b}	500.01 ± 28.43^{b}	384.34 ± 23.44^{c}
Cooking loss	500 ± 33.44^{a}	467.66 ± 42.12^{ab}	467.77 ± 29.18^{b}	434.34 ± 24.12^{c}	384.34±18.43^{d}

*Means followed with the same letter in each column are not significantly different ($p < 0.05$).

DISCUSSION AND CONCLUSION

The results from the study conducted in an interval of the eight weeks of experiment as presented in Tables 2, 3 and 4 revealed that some level of significant variation ($P<0.05$) exist among the mean live-weights and carcass weights of the broilers. In Group 5, which served as the control, broilers were fed with 100% commercial feed and they had the highest mean live-weight, followed by the broilers in Group 4 while group 5 had the least mean weight value.

As indicated in Table 2, theanalysis of variance showed that there was no significant increase in weight of the experimental over the control after eight weeks of experiment. The net weight after eight weeks of experiment showed that those fed with 100% commercial feed was significantly heavier than those fed with 100% formulated feed. The better growth of birds fed with 100% commercial may be as a result of method of processing the feed and its nutritional contents which may be due to anti nutritional content (Tannin and hydrogen cyanide) and also the method of processing. [17] reported that tannin affect the growth of animals in three main ways: They have an astringent taste which affect the palatability and decrease feed consumption, they form complexes with protein and reduce its digestibility, finally they act as an enzyme in activators. Cyanide may cause poisoning to the animal [18] as a result, detoxification by means of processing might be a good means of reducing the level of antinutritional factor. The observed difference in the weight could also be attributed to low nutritional quality of the feeds given to the birds in the individual groups. The control that gains the highest weight better than other groups may be because the feeds were made up all the major ingredients used in the feed formulation unlike the other groups where one of its feed ingredients was substituted with malted sorghum.

A lot of report showed that fish meal, meat meal, palm karnel cake and soya meal cake contain a high level of proteins necessary for the growth of poultry animals including broilers [19]. The low weight gains and growth among the broilers in group 1, 3 and 3 may be as a result of lack of some active ingredients like meat meal and soya meal that was not present in the diet of the group during feed formulation might have contributed to their low average weight. This is because the heated soya meal and meat meal contains up to80% calories and 20% protein may be responsible for the growth, weight gain and

energy in animals including broilers as reported by [20]. In the same vein, the presence of fish meal and palm karnel cake in the diet could perform very well in their weight gain, hence the control performed better than the four groups of broilers due to addition of different active ingredients in their diets during preparation.

However, despite the high level of minerals, proteins and amino acid composition that was present in malted sorghum as reported by [14] there was no change in the organs, after study to investigate the possibility of substituting withmalted sorghum (75 and 100%) for maize in a standard broiler diet and found increased feed intake in broilers as the level ofmalted sorghumincreased in the diets. The parameters obtained in the Table 2 showed no significance variation in the weight of broilers except in group 3 where the laps, breast meat, back cut were significantly smaller than any other parameters in group 2. This means that the carcass of the broilers did not have much influence over the sizes and weights of the broilers in all the groups. The weight gain in the body parts after refrigeration was as a result of moisture absorption which depended on the general meat characteristic and surface area of the broilers chicks as earlier stated by [19]. Consequently, the group 1 broilers which performed better than others in the live- weight had more meat characteristic and surface area; followed by the group 4 and 5 then group 2 while the group 5 had the least live- weight also had the least surface area, this is as a result of effects of the malted sorghum on the growth of the broilers chicks.

[5] stated that increment in the internal organ shows better functionality. However, the parameters of the table 4 does not differs except in group 2 where the laps, breast meat and the back cuts were significantly smaller than any other parameters in group 2. The gain in weight of the body parts after refrigeration was as a result of moisture absorption which depended on the general meat characteristic and surface area of the broilers chicks as earlier stated by [9].

The results of the cooking and drip losses were used to determine the broiler meat characteristic and it was revealed that malted sorghum may not have any effect in cooking and drip losses of meat [2]. However, the low cooking loss of the breast meat of the broilers fed with malted sorghum revealed that the meat is of high quality due to loss of proteins in the water during cooking. Proteins are lost in water due to proteolysis. Proteolysis is low in tougher meats with low fat content as stated by [1] that had reported that the meat with low cooking loss has higher quality and protein content.

It was observed that those fed higher percentages of commercial feed had growth rate, better values in meat characteristic and others qualities. However, this does not signify poor performance of the formulated feeds, rather, indicates that the commercial feeds might have been fortified. There is therefore need for better fortification of such formulated feeds with more growth enhancing ingredients to boost their performance.

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